Adjusted Sparse Tensor Product Spectral Galerkin Method for Solving Pseudodifferential Equations on the Sphere with Random Input Data

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Abstract: An adjusted sparse tensor product spectral Galerkin approximation method based on spherical harmonics is introduced and analyzed for solving pseudodifferential equations on the sphere with random input data. These equations arise from geodesy where the sphere is taken as a model of the earth. Numerical solutions to the corresponding k-th order statistical moment equations are found in adjusted sparse tensor approximation spaces which are accordingly designed to the regularity of the data. Established convergence theorem shows that the adjusted sparse tensor Galerkin discretization is superior not only to the full tensor product but also to the standard hyperbolic cross sparse tensor product counterparts when the data's statistical moments are of mixed unequal regularity. Numerical experiments illustrate our theoretical results.

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